care and skill. The results are remarkably good, both as regards the actual knowledge acquired by the scholars, and the stimulus given to the general intelligence. Besides the above-named subjects, physiology and algebra are often taken with very good results, and in one school the principles of agriculture are taught with marked success."

Some of the causes of this almost total absence of any scientific teaching in the elementary schools have been pointed out. Where science has been well taught, it has borne good fruit; and where teachers and managers have set themselves steadfastly to overcome the difficulties in their way, a high and encouraging measure of success has been obtained. Thus we have the remarkable testimony of the success of the experiment in Nottingham, and surely there are many other districts in England quite as competent to carry on this work as Nottingham. Why it could not be done in any town in England, it is difficult to see. In many cases where these subjects have been taught, the inspectors have wisely set their faces against them, finding but a wretched smattering among the pupils. Nothing else can be expected in remote rural districts, where the teacher, whose whole time is scarcely sufficient for the few rudimentary subjects, is so ambitious as to attempt to cram some of his pupils with the elementary knowledge of a science of which he is himself confessedly ignorant. But in the towns and cities competent teachers are always to be had. If the board masters do not find themselves fit for the extra labor and extra knowledge required, there should be no difficulty in obtaining a specialist, as has been done at Nottingham. And in no place could the foundations of technical education be more surely laid than among the elder children of elementary schools. In the minutes and instructions issued to her Majesty's inspectors, managers are requested to aid, in every way they can, the teaching of one or more specific subjects appropriate to the industrial or other needs of the locality, and the rudiments of two higher subjects to supply a foundation for future work. With this object, it is suggested that where the teacher is not competent to do so, — and this, according to the reports, is the rule, and not the exception, — a specialist might be employed by a number of schools in a district, whose instruction would be supplemented by that of the ordinary teachers. There is only one instance, that of Nottingham, given in the reports, of such suggestions having been followed.

What is said in the report about geography and geography-teaching is of special interest. It appears that while there is a great absence of culture and general intelligence upon the part of a considerable number of candidates, yet the answers to the geography-papers set for admission to the male training-colleges are more accurate than would be supposed.

Here, again, the metropolitan candidates are superior to the provincial candidates, particularly in the map-drawing, though in this particular there has been a falling-away of late. Among the female candidates, the geography was not very satisfactory, exhibiting inaccuracies in map-drawing, indefiniteness in the answers, and generally marks of defective early training. In the examinations for the first year's certificates the male candidates answered fully and accurately; but usually there was a slavish following of the words of the text-books and the lecturers' notes. At the end of the second year there is the same report, — book-knowledge without intelligence, and abundance of information imperfectly digested. With the females the result is the same, — verbatim reproduction of the books or notes they had read; fairly creditable answering; but "the style of the papers reveals the painful poverty of the general reading of the students, and the utter absence of any individuality, or attempt at description in their own words." In many papers there was a constant iteration of the same words and phrases, suggesting that the candidates had learned off by rote the answers to probable questions. With regard to the elementary schools, all the reports agree in saying that there has been a marked improvement in the teaching of geography. Where it is intelligently taught, it is the favorite subject; but too frequently the children are not well grounded. While all parts of the country report progress in geography, it is worthy of remark that all the maritime districts surpass the inland schools in the knowledge of the country, its colonies, and its trade. The report believes that this is only natural, and insists that "the teacher who would not, in Devonshire, interest a class of boys in the voyages of Drake, or who, in Somerset, would not rivet the attention of his pupils on the victories of Blake, would not be worthy of his post." Though the teachers may be congratulated, speaking generally, on the progress made in geography, there are many faults to be found. In portions of Wales and of the centre of England, geography is only fairly satisfactory. The pupils are weak in questions of latitude and longitude: they do not learn intelligently, because most probably they are taught mechanically and unintelligently. It should be within the power of every teacher, by the use of an ordinary globe, to make this portion of the subject intelligible to any ordinary boy. But few lads could understand a lesson on meridians and parallels, given by a teacher who does not use a globe at all; and yet this is quite common. Hence it is that the map-drawing is very poor, even where there is a good knowledge of geographical facts. Many of the inspectors complain of lack of globes, maps, etc.; and, even where there is abundance of general maps, there are no local maps, — a want which is very widely felt. In this respect the Board of Education might take a lesson from the commissioners of national education in Ireland, who have published local maps, and require each pupil in the higher grades to know, in addition to general geography, the map of his neighborhood.

THE IMPROVEMENT OF HARBOR ENTRANCES.

IN 1743, under the direction of Dr. Benjamin Franklin, a movement was started in Philadelphia for the organization of the first scientific society in America; and in a letter from Franklin, under date April 5, 1744, to his friend "Hon^e Cadwallader Colden, Esq.," he says, "The Society, as far as relates to Philadelphia, is actually formed, and has had several Meetings to mutual Satisfaction; — as soon as I get home, I shall send you a short Acct. of what has been done and proposed at these meetings."

This society, which for nearly a century and a half has been known as the 'American Philosophical Society for the Promotion of Useful Knowledge,' has been presided over by the most distinguished of American scientists and scholars, and an election to its membership has been an honor cherished no less by foreigners than by Americans. The society to-day is venerated for its age, distinguished for its services in promoting useful knowledge throughout the continent, and claims for its supporters the greatest scientists, the most cultured scholars, and the most prominent of American engineers who have been active in the dissemination of useful knowledge through improved navigation, the creation of canal and railway systems, the telegraph, and the development of the mechanic arts, by which useful knowledge has become as free to all as the air we breathe.

In 1785 John Hyacinth de Magellan of London, recognizing the prominent position of the society, proposed to donate to the society "200 guineas, to be appropriated as a perpetual Fund; the interest of which to be annually given, in a medal of gold, as a Premium to the author of the best Discovery, or most useful Improvements relating to Navigation or Natural Philosophy." The conditions under which this premium was to be awarded were drafted by a committee of which Dr. Franklin was a member, and were approved by Magellan himself. These conditions are so exacting that but few discoveries have been considered sufficiently important in themselves to merit the high honor of the 'Magellanic Medal,' — an American honor which is esteemed more highly than any to be won by a scientific discoverer in the field of navigation, natural philosophy, or astronomy; which latter subject Magellan subsequently included. It has now been many years since any discoverer has received this medal, although applications are continually presented which seek the prize so zealously guarded by the society.

Last spring a paper was presented to the society, describing a most important discovery in ocean dynamics, under the title 'The Physical Phenomena of Harbor Entrances, their Causes and Remedies. — Defects of Present Methods of Improvements.' This, with other communications, was referred to the consideration of the twelve counsellors and other officers of the society, and on Dec. 16 a favorable report on the discovery was made to the society, and, by a secret ballot of the members, the premium was awarded the same. Upon opening the sealed letter with the same motto as that accompanying the description of the discovery, it was found that

the premium had been awarded Lewis M. Haupt, professor of civil engineering at the University of Pennsylvania. This discovery of authorship was a surprise to the society, since it was thought that the author of the paper would have proved to be a member of the Coast and Geodetic Survey, of the Hydrographic Office, or of the River and Harbor Improvement Service, a number of the members of which have given much attention to the laws of ocean dynamics in determining the improvements to be made annually by the government to our rivers and harbors. The mere announcement, however, of Professor Haupt's name was confirmatory evidence of the wisdom of the society in awarding the medal. Professor Haupt, although an engineer graduate of West Point, has, during the past twenty years of civil professional life as an engineer, won such success and distinction in his profession, that the present honor which he has received only re-enforces the views which are gaining such a stronghold, — that the civilian engineer merits a standing in all government engineering work on the same basis as the regularly commissioned officers.

Tersely, the object of the paper presented to the society was to collate certain observed facts for the purpose of explaining the physical phenomena of harbor entrances, and of deducing therefrom conclusions of practical value in the economical solution of the problem of improving the channels and shelterings of harbors.

What was claimed in the paper as meriting the favorable judgment of the society is briefly outlined by the author as follows: —

"1. The determination of the character, direction, and relative intensities of the forces acting upon any harbor entrance, from a study of the submerged topography and other local physical features.

"2. The discovery of the existence of typical form, in the sandy spits bordering the entrance, which will in general indicate the direction of the resultant movement.

"3. The recognition of the fact that the proper place for the ebb discharge, or channel over the bar, is as far removed as may be from the point of direct attack of the flood resultant, when the direction of the latter is not normal to the coast.

"4. The definite enunciation of the principle that the trend of the coast with reference to the cotidal line will in general indicate at once the proper position for defensive works.

"5. The presentation of an original form (in plan) of breakwater, whereby the natural agencies are materially aided, without serious interference with either the flood or ebb forces.

"6. A method of improvement whereby the internal currents are concentrated and conserved for more efficient scour after passing the gorge.

"7. A plan for utilizing the natural tendencies of the flood to cut a beach channel which shall be available for the lighter-draught vessels.

"8. The enunciation of the principle that the cause of the angular movement of the ebb stream after egress is due to the general form of the exterior coast-line, which causes a racing of the tidal crests, from the outer capes towards the bight of the bay, and that the flood components thus generated are the forces which build the bars and shift the inlets. This incessant semi-diurnal action of the flood is the controlling element in the forces affecting the magnitude and position of the bar. Storms and winds may modify and shift the deposits, but eventually the flood re-establishes the original conditions.

"9. The free circulation and ingress given to the flood by the detached breakwater, so designed as both to oppose the flood and produce interfering waves which deposit sand outside of the channel, whilst it also aids the ebb in its attack on the bar by defending its channel and concentrating its volume.

"10. For a given site and stage of water, the flood movement approaches in the same direction, hence the resisting and regulating works should be placed on the near side of the proposed channel. If on the far side, they would be worse than useless, unless for shore protection.

"11. No artificial re-opening of an outlet which has been closed by this flood component can be maintained without auxiliary works to deflect and modify its action. Dredging is only justified when the interests of navigation are sufficient to maintain a continuance of the expense, and no other reasonable methods are available.

"12. The ability resulting from these general principles to construct works requiring a lesser linear development which will produce greater navigable depths at less cost.

"13. The abolition of the risks and difficulties attending the navigation of narrow jetty entrances in times of danger.

"14. It frequently happens that the requirements of navigation and tidal concentration are conflicting: the former demanding wide entrances; the latter, on account of insufficient tidal volume, narrow ones. This debars the usual jetties, and prevents improvement. The plans herein proposed are eminently adapted to meet such contingencies."

The last-mentioned condition applies in a significant way to the conditions at Absecon and other inlets.

The phenomena of tidal movements, and their bearing upon the formation and destruction of barriers in harbor basins, are of course influenced not only by the topography of the coast-line, but by that of the bottom of the harbor itself, both of which features are in turn perpetuated or changed in form by the relative resistance of the material forming the bottom of the harbor, and the direction and force of currents due to fresh water and tidal movements, winds, and waves. Yet, at the same time, little has been correctly understood as to the laws governing these movements. The new conditions which Professor Haupt so ably enunciates in his paper throw much light on the study of the history of our offshore waterways, as shown by an inspection of those extending along the Atlantic coast, as exhibited by the Coast Survey charts. This is particularly realized in an examination of our southern bay, extending from Cape Florida to Cape Hatteras, and of our middle bay, from Cape Hatteras to Nantucket. The application by Professor Haupt, of his principles and discovery to local conditions along this coast-line, is unique and forcible. It is certainly evident to an intelligent and experienced engineer, as Professor Haupt himself indicates, that, if it is proposed to aid nature, the engineer "must so design his external works as to prevent the flood-tide from carrying sand into the channel to obstruct the ebb and require more work of it for its removal." His system is based upon an internal concentration of the ebb currents in their path to the gorge, and of their external conservation after passing through this section to the ocean.

A paper narrating a discovery so important in ocean dynamics as this, cannot be fully reviewed or fairly treated in a brief space; but one of the most convincing arguments in support of the conditions enumerated above is the application of the discovery to the cause and direction of the tidal movements in Barnegat Inlet as bearing upon the location of the light-house which was erected in 1834, but which was subsequently destroyed prior to the erection of the second structure in 1858. This latter structure has been ineffectually 'protected' by a system of jetties, and it is now evident, in the light of the investigation of this particular case, that the structure has been improperly placed on the spit opposed to the flood resultant. If the light had been placed on the north spit, the interests of navigation would, no doubt, have been as well protected, and all the defensive works which have been constructed at great cost to the government would have been rendered entirely unnecessary.

Lentz, in his 'Ebb and Flow of Tides,' says, "The intricate, theoretical, tide-generating conditions are complicated by a number of circumstances, forming a bewildering labyrinth of causes and results, through which the human mind cannot find its way." When one bears in mind such a statement from an authority so high, too much cannot be said in praise of Professor Haupt's discovery in its bearing on "useful improvements relating to navigation" as well as "natural philosophy," and of the high honor conferred upon him by the American Philosophical Society in awarding him the Magellanic premium. C. A. A.

EXPLORATION AND TRAVEL.

Notes on the Geography of Labrador.

THE December number of the *Bulletin of the American Geographical Society* contains a paper by A. S. Packard on the physical geography of Labrador. The paper is accompanied by a map of Labrador, compiled by F. Leuthner, and said to show the present state of our knowledge. It is founded on the British